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## INSTRUMENT APPROACH PROCEDURES ANALYSIS

### Introduction

This chapter presents an inventory of existing instrument approaches at the Arizona system airports and the bases for establishing new approaches utilizing global positioning system (GPS) technology. It concludes with a defined instrument approach capability for each airport consistent, to the extent possible, with the objectives of the analysis and an emphasis on presenting a viable and practical solution.

The material is presented in text and tabular format. The tables are organized in a fashion that allows the reader to follow the situational status of a particular airport as its instrument approach capability requirement is identified and evaluated in sequence. The report text provides informational support to complement the material presented in the tables.

### Existing Instrument Approach Procedures

Table 5-1 presents a listing of each published instrument approach procedure (IAP) to the system of airports as of November 6, 1997 and associated minimums and restrictions. Inasmuch as this study focuses primarily on the needs of general aviation users, the minimums presented are those applicable to aircraft approach category B as defined in "The United States Standard for Terminal Instrument Procedures (TERPS)". This category includes those aircraft with approach speeds of between 91 knots and 121 knots, a range that includes all general aviation, small commuter and some business jets.

For the benefit of the reader, a translation of terms and acronyms used in this report and others as may be useful is presented in Appendix A and illustrated in the following example: NDB or GPS 17, 500-1 – the NDB or GPS 17 specifies that an NDB facility or GPS waypoints are used to establish an instrument approach to Runway 17. The term 500-1 designates that the ceiling minimum is 500 feet above the touchdown elevation and the visibility minimum is 1 statute

mile. When the reported visibility is equal to or greater than 1 statute mile, as in this example, the pilot may descend to a 500-foot height above the touchdown (HAT) elevation and continue the approach below 500 feet HAT if the aircraft is in a position from which a normal approach can be made, and the approach threshold of the intended runway, or associated approach lights or other markings are clearly visible.

The majority of existing instrument approach procedures are established on a ground-based terminal navigational aid (NAVAID), many of which carry a global positioning system (GPS) overlay designation. There are 12 stand-alone GPS procedures, some to the same runway ends also served by a ground-based NAVAID but with different approach minimums, and 2 stand-alone GPS circling procedures. A stand-alone GPS approach is a procedure designed solely on the use of waypoints, or positions in space used to navigate to a specific runway end or the airport in general as part of a circling approach.

TERPS prescribes standardized methods for use in designing instrument flight procedures. These methods provide for the definition of approach and missed approach surfaces whose shapes, dimensions and slopes vary dependent upon the type of instrument approach under consideration. Obstacles which penetrate the applicable surfaces, or for which there is insufficient clearance between the obstacle and the surface require increases to the lowest authorized minimums of the approach procedure. Approach lighting systems may provide a ¼-mile reduction in visibility minimums; however, this is dependent on meeting certain criteria with respect to obstacles and approach surfaces.

TERPS also defines increases or penalties to the ceiling component of an approach minimum (which, in turn, can modify the visibility minimum) to account for the unavailability of a local altimeter setting source or the use of a remote airport altimeter setting, and the presence of precipitous terrain. Penalties assigned due to the latter are of a subjective nature reflecting the skill and judgement of the Federal Aviation Administration (FAA) flight procedures specialist designing the procedure, whereas penalties associated with the first two conditions can be calculated. In some cases, the lack of a local altimeter setting results in non-authorization of the approach procedure. Instances where the approach minimums are subject to increase due to the unavailability of a local altimeter setting source and the extent of such penalties, including non-authorization of the procedures, are noted in Table 5-1. The provision of an automated weather observing system will be considered in a subsequent chapter of this report to enhance the potential utilization of the instrument approach procedure.

Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

Airport	Existing IAPs (Type) (HAA/HAT-VIS) (Notes)		
Ajo Municipal	None		
Ak-Chin Community	None		
Avi Suquilla	VOR/DME or GPS-A 1300'-1½ Note 1; 200'		
Avra Valley	None		
Bagdad	None		
Benson Municipal (New)	None		
Bisbee Douglas International	VOR/DME or GPS 17 317-1		
Bisbee Municipal	None		
Bowie	None		
Buckeye Municipal	None		
Casa Grande Municipal	ILS/DME 5 285-½ Note 1; 140'	VOR 5 484-½ Note 1; 140'	GPS 5 424-½
Chandler Municipal	VOR or GPS 4L 446-1 Note 1; 40'	NDB 4R 541-1	VOR or GPS-A 465-1 Note 2
Chinle	None		
Cliff Dwellers Lodge	None		
Cochise College	None		
Cochise County	GPS 21 354-1 Note 3	GPS-A 454-1 Note 3	

Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

<b>Airport</b>	<b>Existing IAPs (Type) (HAA/HAT-VIS) (Notes)</b>			
Colorado City Municipal	NDB-A 829-1¼ Note 3			
Coolidge Municipal	VOR/DME 5 452-1¼ Note 4	GPS 23 486-1 Note 4		
Cordes Lake (New)	None			
Cottonwood Municipal	None			
Douglas Municipal	None			
Duncan-O'Connor Field (Closed)	None			
Eloy Municipal	None			
Ernest A. Love Field	ILS/DME 21L 200-½	VOR/DME RNAV 21L 443-½	VOR 12 519-1	GPS12 419-1
	GPS 21L 443-½			
Estrella Sailport	None			
Flagstaff-Pulliam	ILS/DME 21 250-½	VOR/DME 21 400-1	VOR or GPS-A 688-1	NDB/DME 21 760-1¼
	GPS 21 420-1			
Flying J Ranch	None			
Ganado	None			
Gila Bend Municipal	None			

Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

Airport	Existing IAPs (Type) (HAA/HAT-VIS) (Notes)	
Glendale Municipal	None	
Globe-San Carlos Regional	None	
Grand Canyon Bar-Ten	None	
Grand Canyon Caverns	None	
Grand Canyon National Park	ILS/DME 3	VOR 3
	200-½	546-½
	Note 5	Note 5
Grand Canyon West	None	
Greasewood (Closed)	None	
Greenlee County	None	
H.A. Clark Memorial Field	None	
Holbrook Municipal	None	
Hualapai Tribal	None	
Kayenta	None	
Kearny	None	
Kingman	VOR/DME or GPS 21	
	359-1	
	Note 3	
Lake Havasu City Municipal	VOR/DME or GPS-A	
	939-1¼	
	Note 3	
Laughlin/Bullhead International	VOR/DME 34	GPS 34
	1708-1½	1208-1½
	Note 6	Note 6

Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

Airport	Existing IAPs (Type) (HAA/HAT-VIS) (Notes)			
Libby AAF/Sierra Vista	ILS 26 200-¾ Note 7	VOR or GPS 26 434-1 Note 7	NDB 26 494-1 Note 7	
Low Mountain (Closed)	None			
Lukachukai	None			
Marble Canyon	None			
Memorial Airfield	None			
Mesa-Falcon Field	NDB or GPS-A 468-1 Note 1; 60'	GPS 4R 419-1 Note 1; 60'		
Nogales International	VOR/DME or GPS-B 1268-1½ Note 8	VOR or GPS-A 1568-1½ Note 8	NDB or GPS-C 2648-1½ Note 8	
Page Municipal	VOR or GPS-A 690-1	GPS 15 435-1		
Payson	None			
Pearce Ferry	None			
Phoenix-Deer Valley	NDB or GPS 25L 1107-1½ Note 1; 80'	GPS 7R 562-1 Note 1; 80'	GPS-A 924-1¼ Note 1; 80'	
Phoenix-Goodyear	None			
Phoenix-Sky Harbor International	ILS 8R 200-½	ILS 26R 250-¾	LOC BC 26L w/DME 510-1	GPS 26R 667-1
	VOR/DME or GPS 26L 610-2	GPS 8L 945-1¼	VOR/DME or GPS 8R 427-½	

Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

Airport	Existing IAPs (Type) (HAA/HAT-VIS) (Notes)		
Pinal Airpark	None		
Pine Springs	None		
Pinon	None		
Pleasant Valley International	None		
Polacca	None		
Quartzsite (New)	None		
Rock Point	None		
Rocky Ridge	None		
Rolle Airfield	None	419-1	
Ryan Airfield	ILS 6R	NDB/DME or GPS 6R	NDB or GPS-D
	200-3/4	900-1 1/4	785-1 1/4
	Note 1; 40'	Note 1; 40'	Note 1; 40'
Safford Regional	None		
San Carlos	None		
San Manuel	None		
Scottsdale	VOR or GPS-A	VOR or GPS-C	NDB or GPS-B
	1032-2 1/2	892-2 1/2	652-1
	Note 1; 80'	Note 1; 80'	Note 1; 80'
Sedona	NDB or GPS-A		
	1213-1 1/2		
	Note 3		
Seligman	None		
Sells	None		
Shonto	None		

Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

Airport	Existing IAPs (Type) (HAA/HAT-VIS) (Notes)		
Show Low Municipal	NDB or GPS-A		
	509-1		
	Note 3		
Springerville Babbit Field	GPS 21		
	321-1		
	Note 3		
St. Johns Industrial Airpark	VOR/DME or GPS-A		
	507-1		
	Note 3		
Stellar Airpark	VOR or GPS-A		
	465-1		
	Note 2		
Sun Valley	None		
Superior Municipal	None		
Taylor Municipal	None		
Temple Bar	None		
Tombstone Municipal	None		
Toyei School (Closed)	None		
Tuba City	None		
Tucson International	ILS 11L	LOC/DME BC 29R	VOR or TACAN or GPS 11L
	200-½	479-1	264-½
	VOR/DME or TACAN or GPS 29R		
	479-1		
Tuweep	None		



Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

Airport	Existing IAPs (Type) (HAA/HAT-VIS) (Notes)		
Whiteriver	None		
Wickenburg Municipal	None		
Williams Gateway	ILS 30C	VOR or TACAN or GPS 30C	
	200-¾	502-1	
	Note 1; 80', ¼	Note 1; 80', ¼	
Window Rock	VOR/DME or GPS-A	RNAV or GPS 2	
	983-1½	786-1¼	
	Note 4	Note 1; 60'	
Winslow Municipal	VOR or GPS 11		
	423-1		
	Note 3		
Yuma International	ILS 21R	VOR/DME or GPS 17	VOR 17
	200-½	404-1	404-1
	RNAV or GPS 21R		
	427-½		

Table 5-1  
**EXISTING INSTRUMENT APPROACH PROCEDURES**

Airport	Existing IAPs (Type) (HAA/HAT-VIS) (Notes)
<b>Note 1</b>	Obtain local altimeter setting on CTAF; when not received, use specified airport altimeter setting and increase MDA/DH and VIS as indicated.
<b>Note 2</b>	Use specified airport altimeter setting. Procedure not authorized at night.
<b>Note 3</b>	Obtain local altimeter on CTAF; when not available, procedure not authorized.
<b>Note 4</b>	Use specified airport altimeter setting.
<b>Note 5</b>	When control zone not in effect, except for operators with an approved weather reporting service, procedure not authorized.
<b>Note 6</b>	Obtain local altimeter setting on CTAF; when not received, except for operators with approved weather reporting service, procedure not authorized.
<b>Note 7</b>	Procedure not authorized when control tower closed, except for operators with approved weather reporting service.
<b>Note 8</b>	Use specified airport altimeter setting; when not received, procedure not authorized.

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See Appendix A for acronym definitions.

Source: U.S. Terminal Procedures, June 1998.

## Desired Instrument Approach Capability

Traditionally, establishing a desired instrument approach capability at an airport would consider such factors as the role of the airport, activity levels, its contribution to the overall economic stability of its service area, and the life-cycle cost of establishing, maintaining and operating a ground-based NAVAID. Incremental gains in airport and runway operational capability achieved as a result of lowering approach minimums would also be incorporated into the analysis. In this manner, a matrix of airport role/activity levels/desired instrument approach capabilities could be defined. The next step in the process would be to evaluate means to achieve the desired instrument approach capability if it was not currently met.

The introduction of GPS technology to civil aviation use necessitates a re-examination of this traditional approach. This is because the GPS signal is satellite-generated, thereby eliminating the relatively high cost of establishing and maintaining a ground-based NAVAID. Further, new standards associated with the airport landing surface and runway facility design to support new instrument approach procedures have been issued by the FAA. Although these standards have been in effect to evaluate other physical and facilities needs at the airport, their recent tie to achievable ceiling and visibility minimums serves to strengthen their importance with respect to the establishment of instrument approach procedures.

QED considers that the ability of an airport to meet applicable landing surface and facility design standards will be used by the FAA to establish priorities in publishing stand-alone GPS procedures, if at all, depending on the circumstances at the airport under consideration. A key factor in this evaluation is the ability of the airport to meet those standards associated with ceilings equal to or less than 400 feet HAT and visibilities less than  $\frac{3}{4}$ -statute mile inasmuch as these standards are more rigorous than those for approaches with higher ceiling and visibility minimums.

Table 5-2 summarizes a review of the landing surface standards associated with key approach minima classifications. The premise to this review reflects the rationale that airports be developed or be reasonably capable of meeting standards which are related to the safety of aircraft operations conducted during periods of low ceilings and visibilities. From the point of view of the pilot, there should be an expectation that the physical characteristics of the airport are compatible with the instrument approach and allows for the potential to land safely within a margin of pilot/aircraft proficiency. The FAA has implicitly established airport and landing surface standards by applying similar reasoning.

A desired or target visibility minimum was selected and presented in Table 5-2 based on the results of this standards review with input from the ADOT Aeronautics staff. A target ceiling minimum was not identified because airport design standards are influenced by the aircraft approach category and visibility minimum. Certain airports were targeted to achieve ½-mile visibility minimums irrespective of their ability to meet the standards due to their system role and/or relatively high activity level. The review was conducted from available mapping and data for each airport. These materials were unavailable for several airports and therefore an assessment could not be made.

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Table 5-2  
DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-¼	300-¾	400-1	
Ajo Municipal	None	No No Comments	No	Yes	1
Ak-Chin Community	None	-- ALP not available.	--	--	1
Avi Suquilla	VOR/DME or GPS-A 1271-1½	No Land available for SSALS on R/W 19.	Yes	Yes	1
Avra Valley	None	No Requires land acquisition for MALSR to achieve 1/2 mile visibility.	No	Yes	½
Bagdad	None	No No Comments.	No	Yes	1
Benson Municipal (New)	None	No Airport to be designed to meet applicable standards.	No	Yes	1
Bisbee Douglas Int'l	VOR/DME or GPS 17 317-1	Yes Land available for SSALS or MALSR on R/W 17.	Yes	Yes	1
Bisbee Municipal	None	No No Comments.	No	Yes	1
Bowie	None	No Does not meet applicable primary surface, ROFA or RSA standards.	No	No	1
Buckeye Municipal	None	No Does not meet applicable ROFA or RSA standards.	No	No	1
Casa Grande Municipal	ILS/DME 5 285-½	Yes No Comments.	Yes	Yes	½

**Table 5-2**  
**DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY**

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Chandler Municipal	VOR or GPS 4L 446-1	No	No	Yes <i>Primary surface standard met on R/W 4R-22L. Requires land acquisition for MALSR on R/W 4R.</i>	½
Chinle	None	-- <i>ALP not available.</i>	--	--	1
Cliff Dwellers Lodge	None	-- <i>ALP not available.</i>	--	--	1
Cochise College	None	No	No	No <i>Does not meet applicable ROFA or RSA standards.</i>	1
Cochise County	GPS 21 354-1	No	Yes	Yes <i>Land available for SSALS on R/W 3.</i>	1
Colorado City Municipal	NDB-A 829-1½	No	No	Yes <i>No Comments.</i>	1
Coolidge Municipal	GPS 23 486-1	No	Yes	Yes <i>Land available for SSALS on R/W 23.</i>	1
Cordes Lake (New)	None	No	No	Yes <i>Airport to be designed to meet applicable standards.</i>	1
Cottonwood Municipal	None	No	Yes	Yes <i>Land available for SSALS on R/W 14.</i>	1
Douglas Municipal	None	No	Yes	Yes <i>Land available for SSALS on R/W 21.</i>	1
Duncan-O'Connor Field (Closed)	None	No	No	No <i>Does not meet applicable standards for primary surface, ROFA or RSA.</i>	1
Eloy Municipal	None	No	No	Yes <i>No Comments.</i>	1

Table 5-2  
DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Ernest A. Love Field	ILS/DME 3 200-½	Yes No Comments.	Yes	Yes	½
Estrella Sailport	None	-- Airport not intended for IFR use.	--	--	--
Flagstaff-Pulliam	ILS/DME 21 250-½	Yes No Comments.	Yes	Yes	½
Flying J Ranch	None	-- ALP not available.	--	--	1
Ganado	None	-- ALP not available.	--	--	1
Gila Bend Municipal	None	No Does not meet applicable ROFA or RSA standards.	No	No	1
Glendale Municipal	None	No Does not meet applicable standards for primary surface, ROFA or RSA. Land available for MALSR on R/W 1.	Yes	Yes	½
Globe-San Carlos Regional	None	No No Comments.	No	Yes	1
Grand Canyon Bar-Ten	None	-- ALP not available.	--	--	1
Grand Canyon Caverns	None	-- ALP not available.	--	--	1
Grand Canyon Nat'l Park	ILS/DME 3 200-½	Yes No Comments.	Yes	Yes	½
Grand Canyon West	None	No No Comments.	No	Yes	1

**Table 5-2**  
**DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY**

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Greasewood (Closed)	None	-- <i>ALP not available.</i>	--	--	1
Greenlee County	None	No <i>No Comments.</i>	No	Yes	1
H.A. Clark Memorial Field	None	No <i>Does not meet applicable ROFA or RSA standards.</i>	No	No	1
Holbrook Municipal	None	No <i>No Comments.</i>	No	Yes	1
Hualapai Tribal	None	-- <i>ALP not available.</i>	--	--	1
Kayenta	None	-- <i>ALP not available.</i>	--	--	1
Kearny	None	No <i>Does not meet applicable standards for primary surface, ROFA or RSA.</i>	No	No	1
Kingman	VOR/DME or GPS 21 359-1	No <i>Does not meet applicable standards for primary surface. Inner OFZ standard met on R/W 21. Land available for MALSR on R/W 3 and R/W 21.</i>	No	Yes	½
Lake Havasu City Municipal	VOR/DME or GPS-A 939-1¼	Yes <i>Applicable standards for Inner OFZ and TERPS 332 not met on R/W 14. Land for MALSR available on R/W 14.</i>	Yes	Yes	½



Table 5-2  
DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Laughlin / Bullhead International	GPS 34 1208-1½	No	Yes	Yes <i>Applicable standards for Inner OFZ and TERPS 332 met on R/W 16. Requires land acquisition for MALSR to achieve ½-mile visibility.</i>	½
Libby AAF/Sierra Vista	ILS 26 200-¾	Yes	Yes	Yes <i>Land available for MALSR on R/W 26.</i>	½
Low Mountain (Closed)	None	--	--	-- <i>ALP not available.</i>	1
Lukachukai	None	--	--	-- <i>ALP not available.</i>	1
Marble Canyon	None	--	--	-- <i>ALP not available.</i>	1
Memorial Airfield	None	--	--	-- <i>ALP not available.</i>	1
Mesa-Falcon Field	GPS 4R 419-1	No	No	Yes <i>Applicable standard for Inner OFZ not met on R/W 4R. Land available for MALSR on R/W 4R, but requires road crossing.</i>	½
Nogales International	VOR/DME or GPS-B 1268-1½	No	No	Yes <i>No Comments.</i>	1
Page Municipal	GPS 15 435-1	No	Yes	Yes <i>Land available for SSALS on R/W 33. Land acquisition required for MALSR on on R/W 15 and R/W 33.</i>	½

Table 5-2  
DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Payson	None	No <i>No comments.</i>	No	Yes	1
Pearce Ferry	None	-- <i>ALP not available.</i>	--	--	1
Phoenix-Deer Valley	GPS 7R 562-1	No <i>Applicable standard for Inner OFZ not met on R/W 7R. Requires land acquisition for R/W 7R MALSR. Land available for SSALS on R/W 7R.</i>	No	Yes	½
Phoenix-Goodyear	None	No <i>Applicable standard for Inner OFZ met on R/W 3. Requires land acquisition for MALSR on R/W 3.</i>	Yes	Yes	½
Phoenix-Sky Harbor International	ILS 8R 200-½	Yes <i>No comments.</i>	Yes	Yes	½
Pinal Airpark	None	No <i>Land available for SSALS on R/W 12.</i>	Yes	Yes	1
Pine Springs	None	-- <i>ALP not available.</i>	--	--	1
Pinon	None	-- <i>ALP not available.</i>	--	--	1
Pleasant Valley International	None	-- <i>ALP not available.</i>	--	--	1
Polacca	None	-- <i>ALP not available.</i>	--	--	1
Quartzsite (New)	None	No <i>Airport to be designed to applicable standards.</i>	No	Yes	1

Table 5-2  
DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Rock Point	None	-- <i>ALP not available.</i>	--	--	1
Rocky Ridge	None	-- <i>ALP not available.</i>	--	--	1
Rolle Airfield	None	No <i>No comments.</i>	No	Yes	1
Ryan Airfield	ILS 6R 200-¾	No <i>Requires land acquisition for MALSR on R/W 6R.</i>	Yes	Yes	½
Safford Regional	None	No <i>No comments.</i>	No	Yes	1
San Carlos	None	-- <i>ALP not available.</i>	--	--	1
San Manuel	None	-- <i>ALP not available.</i>	--	--	1
Scottsdale	NDB or GPS-B 652-1	No <i>Does not meet applicable standards for primary surface and ROFA. Requires land acquisition for MALSR on R/W 3.</i>	No	Yes	½
Sedona	NDB or GPS-A 1213-1½	No <i>Does not meet applicable standard for ROFA.</i>	No	No	1
Seligman	None	No <i>Does not meet applicable standards for primary surface and ROFA.</i>	No	No	1
Sells	None	-- <i>ALP not available.</i>	--	--	1

**Table 5-2**  
**DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY**

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Shonto	None	-- <i>ALP not available.</i>	--	--	1
Show Low Municipal	NDB or GPS-A 509-1	No <i>Requires land acquisition for MALSR.</i>	No	Yes	½
Springerville Babbit Field	GPS 21 321-1	No <i>No Comments.</i>	No	Yes	1
St. Johns Industrial Airpark	VOR/DME or GPS-A 507-1	No <i>Does not meet applicable standards for primary surface and ROFA.</i>	No	No	1
Stellar Airpark	VOR or GPS-A 465-1	-- <i>ALP not available.</i>	--	--	1
Sun Valley	None	-- <i>ALP not available.</i>	--	--	1
Superior Municipal	None	-- <i>ALP not available.</i>	--	--	1
Taylor Municipal	None	No <i>No Comments.</i>	No	No	1
Temple Bar	None	-- <i>ALP not available.</i>	--	--	1
Tombstone Municipal	None	No <i>No Comments.</i>	No	Yes	1
Toyel School (Closed)	None	-- <i>ALP not available.</i>	--	--	1
Tuba City	None	-- <i>ALP not available.</i>	--	--	1

Table 5-2  
DESIRED / TARGET INSTRUMENT APPROACH CAPABILITY

Airport	Present Best IAP <sup>1</sup>	Ability to Meet Standards for Approach Minimums and Comments <sup>2</sup>			Desired/Target Visibility (sm) <sup>2</sup>
		200-½	300-¾	400-1	
Tucson International	ILS 11L 200-¾	Yes <i>No comments.</i>	Yes	Yes	½
Tuweep	None	-- <i>ALP not available.</i>	--	--	1
Whiteriver	None	-- <i>ALP not available.</i>	--	--	1
Wickenburg Municipal	None	No <i>No comments.</i>	No	Yes	1
Williams Gateway	ILS 30C 200-¾	Yes <i>No comments.</i>	Yes	Yes	½
Window Rock	RNAV or GPS 2 786-1¾	No <i>No comments.</i>	No	Yes	1
Winslow Municipal	VOR or GPS 11 423-1	No <i>No comments.</i>	No	Yes	1
Yuma International	ILS 21R 200-½	Yes <i>No comments.</i>	Yes	Yes	½

Note: See Appendix A for acronym definitions.

Sources: 1. Table 5.1.

2. QED.

## GPS Analysis

The GPS analysis was based on the procedures outlined in TERPS and, more specifically, those FAA Orders that provide the criteria in the use of GPS for navigation. The latter include:

1. FAA Order 8260.38A, "Civil Utilization of Global Positioning System (GPS)". This order applies to instrument procedures based on GPS airborne equipment meeting en route, terminal and "nonprecision" requirements of technical standard order (TSO) C-129, "Airborne Supplemental Navigation Equipment Using the GPS".
2. FAA Order 8260.36A, "Civil Utilization of Microwave Landing System (MLS)". Although developed for MLS procedures, the criteria contained in this order applies to the use of GPS "precision" procedures.

For the purposes of this study, the architecture for the wide area augmentation system (WAAS) is expected to meet the required navigation performance (RNP) standards for "nonprecision" and Category I "precision" approaches.

### "Precision" and "Nonprecision" Vernacular

It is appropriate at this juncture to introduce the reader to a likely change in terminology related to instrument approaches. Currently, instrument approaches are categorized as "precision" or "nonprecision". The difference is linked to the availability of vertical guidance during the approach procedure. When lateral and vertical guidance is communicated to the pilot/aircraft, the approach is termed a "precision" approach. A "nonprecision" approach is one for which only lateral guidance is available. The ceiling minimum in a "precision" approach is termed a decision height (DH); for "nonprecision" approaches, the term minimum descent altitude (MDA) is used. For many users, the term "precision" also implies minimums of 200-foot ceiling and ½-mile visibility, also referred to as Category I.

The above terminology may change when the use of GPS becomes more widespread and standards for use are finalized. Because GPS provides both lateral and vertical guidance information, all GPS approaches may be considered "precision with variable decision heights". Approach minimums for GPS procedures will range from the Category I standard (200'-½) to higher values. Yet, each will be considered "precision". Consequently, this report seeks to adopt a new vernacular when describing GPS approaches. Terms "precision" and "nonprecision" are not used and the reader should refer to the minimums associated with the procedure. These minimums correlate with airport landing surface and design standards to which airport facilities should be developed.

## GPS Analysis Findings

The use of GPS technology to meet the desired visibility component of the approach minimums as outlined in Table 5-2 is dependent not only on the height and location of obstacles in the approach and missed approach surfaces, but the availability of an appropriate approach lighting system and a final approach fix. Generally, the ceiling minimum, which is determined based on a review of obstacles underlying the applicable approach surface, also establishes a floor level for the visibility minimum and this relationship varies based on the type of approach and category of aircraft. In most instances, for example, when evaluating an approach procedure which results in a relatively high ceiling minimum (between 741 feet and 950 feet HAT for category B aircraft), the corresponding visibility minimum is 1¼ miles assuming that a final approach fix is available. An appropriate approach lighting system (ALS) could lower the visibility by ¼-mile under most circumstances. It should be noted that due to the complexity of TERPS guidelines and the variety of situations which can arise, the examples presented above and elsewhere in this report are intended to be illustrative and general in nature of the evaluation procedure and not all inclusive. Further, the analysis assumed that each airport would be capable of providing a local altimeter setting source so that the approach procedure would be available at all times or the minimums would not be increased with a remote altimetry penalty.

The simplified short approach lighting system (SSALS) is the least sophisticated facility in terms of size and features which can be installed to gain a ¼-mile visibility credit. The medium intensity approach lighting system with runway alignment indicator lights (MALSR) is the standard facility for Category I approaches.

With the foregoing as a basis, Table 5-3 succinctly summarizes the results of the GPS analysis for each airport. The table is organized by airport, desired or target visibility minimum, present best instrument approach and minimums, an initial potential instrument approach to best match the desired or target level and the resultant minimums, and any comments or factors which influenced that determination. The "Comments" section of Table 5-3 provides a summarization of the key findings in each airport evaluation. The term OCS refers to the obstacle clearance surface defined for GPS approaches intended to have ½-mile visibility minimums. The OCS has three sets of sloping surfaces (W, X and Y) which make obstacles further distant from the runway threshold or offset from the approach alignment less of an influencing factor in the approach minimums determination.

Table 5-3 summarizes the results for each system airport. These are initial findings inasmuch as airport system and other aviation needs associated with enhanced IAP capabilities have not yet been addressed and may affect a final determination.

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Table 5-3  
INITIAL GPS ANALYSIS

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Ajo Municipal	1	None	GPS 30 402-1
<i>Controlling obstacle is terrain at 1600' MSL 26,800' SE. Requires 20° right turn missed approach procedure to avoid high terrain at 1800' MSL 15,000' NW.</i>			
Ak-Chin Community	1	None	GPS 17 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Avi Suquilla	1	VOR/DME or GPS-A 1271-1½	GPS 1 271-1
<i>Controlling obstacle is terrain at 460' MSL 3,000' SE. GPS 19 yields 651-1 due to terrain at 840' MSL 27,000' N.</i>			
Avra Valley	½	None	GPS 12 200-1/2
<i>OCS clear. Final approach course could overfly Pinal Air Park. Requires left turn missed approach procedure to avoid Panther Peak at 3453' MSL 22,700' SE in missed approach segment. Rillito Point at 2503' MSL not a factor. Airspace interaction with Tucson International minimized due to similar course alignment. Requires land acquisition to install MALSR. Procedure dependent on establishment of WAAS by FAA. "Nonprecision" GPS 12 yields 250-¾ with SSALS.</i>			
Bagdad	1	None	GPS 5 1057-1½
<i>Controlling obstacle is terrain in Blue Mountains at 5560' MSL 23,000' NE in missed approach segment.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Benson Municipal (New)	1	None	GPS 28 250-1
<i>Final approach and missed approach segments clear.</i>			
Bisbee Douglas International	1	VOR/DME or GPS 17 317-1	Same
<i>Meets target IAP capability. Minimums can be lowered to 317-½ with installation of SSALS if considered justified; land available.</i>			
Bisbee Municipal	1	None	GPS-A 1120-1½
<i>Mexican border to south requires approach to R/W 17 and a turning missed approach to maintain procedures in US airspace. High terrain including Mt. Martin at 7160' MSL yields unacceptably high minimums (2400-2). Offset alignment (15° N) provides minimal relief. A circling approach originating W of the airport and straight missed approach segment is viable.</i>			
Bowie	1	None	GPS 26 250-1
<i>Final approach and missed approach segments clear. Airport requires improvements to meet applicable primary surface, ROFA and RSA standards.</i>			
Buckeye Municipal	1	None	GPS 25 250-1
<i>Final approach and missed approach segments clear. Airport requires improvements to meet applicable ROFA and RSA standards.</i>			
Casa Grande Municipal	½	ILS/DME 5 285-½	GPS 5 200-½
<i>Existing approach minimums based on flight check value associated with glide slope reception (glide slope unusable below 1665' MSL). Procedure dependent on establishment of WAAS by FAA.</i>			

Table 5-3  
INITIAL GPS ANALYSIS

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Chandler Municipal	½	VOR or GPS 4L 446-1	GPS 4R 200-½
<i>Airspace environment suggests procedure to NE. Airport layout and compliance with applicable design standards favor R/W 4R. Requires land acquisition to install MALSR. Procedure dependent on establishment of WAAS by FAA. "Nonprecision" GPS 4R yields 250-1; and 250-¾ with SSALS.</i>			
Chinle	1	None	GPS 17 365-1
<i>Controlling obstacle is powerline at 5615' MSL 1,800' S.</i>			
Cliff Dwellers Lodge	1	None	GPS 22 663-1
<i>Controlling obstacle is terrain at 4617' MSL 3,000' NE. Requires left turn missed approach to avoid high terrain at Walts Bench (4400' MSL 9,500' S). Survey airport to determine compliance with applicable design standards.</i>			
Cochise College	1	None	GPS 23 250-1
<i>Proximity of Mexican border requires approach from the NE. Requires turn for missed approach to maintain procedure within US airspace. Airport requires improvements to meet applicable ROFA and RSA standards.</i>			
Cochise County	1	GPS 21 354-1	Same
<i>Meets target IAP capability.</i>			
Colorado City Municipal	1	NDB-A 829-1¼	GPS 29 489-1
<i>Controlling obstacle is terrain at 5098' MSL 30,000' E.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Coolidge Municipal	1	GPS 23 486-1	Same
<i>Meets target IAP capability. Minimums can be lowered to 486-¾ with installation of SSALS if considered justified; land available.</i>			
Cordes Lake (New)	1	None	GPS 19 745-1
<i>Controlling obstacle is terrain at 4232' MSL 30,000' N. GPS 1 yields 885-1 based on terrain at 4372' 29,500' S.</i>			
Cottonwood Municipal	1	None	GPS 32 1310-1½
<i>Controlling obstacle is terrain at 4600' MSL 39,000' NW in missed approach segment. GPS 14 yields 1570-1½ due to terrain at 4338' MSL 10,000' E in missed approach segment. SSALS not warranted with relatively high ceiling minimum.</i>			
Douglas Municipal	1	None	GPS 21 427-1
<i>Proximity of Mexican border requires approach from the NE. Controlling obstacle is terrain at 4348' MSL 24000' NE. Requires turning missed approach to remain in US airspace. Minimums can be lowered to 427-¾ with installation of SSALS if considered justifiable; land available.</i>			
Duncan-O'Connor Field (Closed)	1	None	GPS 21 533-1
<i>Controlling obstacle is terrain at 4327' MSL 17,000' SE in missed approach segment. Requires 180° right turn missed approach to avoid higher terrain. Airport requires improvements to meet applicable primary surface, ROFA and RSA standards.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Eloy Municipal	1	None	GPS 20 250-1
<i>Final approach and missed approach segments clear.</i>			
Ernest A. Love Field	½	ILS/DME 21L 200-½	Same
<i>Meets target IAP capability.</i>			
Estrella Sailport	N/A	None	Same
<i>Airport restricted to VFR sailplane activity.</i>			
Flagstaff-Pulliam	½	ILS/DME 21 250-½	GPS 21 200-½
<i>Existing CAT I ILS/DME utilizes offset localizer which establishes the lowest achievable minimums at 250-½. Establishment of WAAS by FAA should eliminate 50' ceiling penalty.</i>			
Flying J Ranch	1	None	GPS 19 550-1
<i>Controlling obstacle is Coyote Knoll at 3900' MSL 20,000' S in missed approach segment. Survey airport to determine compliance with applicable facility design standards.</i>			
Ganado	1	None	GPS 18 398-1
<i>Controlling obstacle is terrain at 6797' MSL 23,000' SW. Airport requires survey to determine compliance with applicable facility design standards.</i>			
Gila Bend Municipal	1	None	GPS 4 302-1
<i>Controlling obstacle is terrain at 813' MSL 23,000' SW. Airport requires improvements to meet applicable ROFA and RSA standards.</i>			

**Table 5-3**  
**INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Glendale Municipal	½	None	GPS 19 250-¾
<i>Airspace interaction with Luke AFB requires 15° E offset alignment. Airport requires installation of SSALS.</i>			
Globe-San Carlos	1	None	GPS 27 565-1
<i>Requires 13° N offset alignment to avoid impact of Bucket Mountain. Requires right turn missed approach to avoid higher terrain. Controlling obstacle is terrain at 3600' MSL 13,000' NW in missed approach segment.</i>			
Grand Canyon Bar-Ten	1	None	Same
<i>Surrounding terrain in all quadrants precludes practical straight-in, offset or circling IAP capability.</i>			
Grand Canyon Caverns	1	None	GPS 23 394-1
<i>Controlling obstacle is terrain at 5845' MSL 16,000' W in missed approach segment. Survey airport to determine compliance with applicable facility design standards.</i>			
Grand Canyon National Park	½	ILS/DME 3 200-½	Same
<i>Meets target IAP capability.</i>			
Grand Canyon West	1	None	GPS 35 305-1
<i>Controlling obstacle is terrain at 4816' MSL 5,000' S.</i>			
Greasewood (Closed)	1	None	GPS 4 300-1
<i>Controlling obstacle is terrain at 6290' MSL 10,000' NE in missed approach segment. Survey airport to determine compliance with applicable facility design standards.</i>			

Table 5-3  
INITIAL GPS ANALYSIS

Airport	Target Visibility (sm) <sup>1</sup>	Present Best IAP (Type, HAA/HAT-VIS) <sup>2</sup>	Initial Potential IAP (Type, HAA/HAT-VIS) <sup>3</sup>
Greenlee County	1	None	GPS 7 949-1¼
<i>Requires 15° N offset alignment to avoid Guthrie Mountain. Requires 180° turn to right in missed approach to avoid highest terrain. Controlling obstacle is terrain at 3846' MSL 17,000' SE.</i>			
H.A. Clark Memorial Field	1	None	GPS 18 1300-1½
<i>Controlling obstacle is Sister Peak at 7644' MSL 18,000' S in missed approach segment. Airport requires improvements to meet ROFA and RSA standards.</i>			
Holbrook Municipal	1	None	GPS 21 323-1
<i>Controlling obstacle is terrain at 5229' MSL 29,000' NE.</i>			
Hualapai Tribal	1	None	GPS 7 483-1
<i>Controlling obstacle is terrain at 5829' MSL 19,000' NE in missed approach segment. Survey airport to determine compliance with applicable facility design standards.</i>			
Kayenta	1	None	GPS 23 510-1
<i>Controlling obstacle is terrain at 6543' MSL 20,500' SW in missed approach segment. Airport requires improvements to meet applicable primary surface, ROFA and RSA standards.</i>			
Kearny	1	None	Same
<i>Surrounding terrain in all quadrants precludes practical straight-in, offset or acircling IAP capability.</i>			
Kingman	½	VOR/DME or GPS 21 359-1	GPS 21 200-½
<i>OCS and missed approach segment clear. Procedure dependent on establishment of WAAS by FAA.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Lake Havasu City Municipal	½	VOR/DME or GPS-A 939-1½	GPS 32 200-½
<i>Noise abatement procedures designate R/W 32 as the calm wind R/W with straight-in and straight-out operations prohibited to avoid overflight of residential areas to the S and SW. OCS and missed approach segment clear. Procedure dependent on establishment of WAAS by FAA. Airport requires improvements to meet applicable primary surface standard and land acquisition for MALSR.</i>			
Laughlin / Bullhead International	½	GPS 34 1208-1½	GPS 34 314-½
<i>Controlling obstacle is Buttshead Point at 1575' MSL 15,000' N in missed approach segment. Turning missed approach procedure does not avoid obstacle. Adjustment to DH required to provide clear missed approach segment. Approach to R/W 16 not viable due to high terrain in final approach segment. Procedure dependent on establishment of WAAS by FAA. Airport requires improvements to meet applicable standards for Inner OFZ, TERPS 332 and land acquisition for MALSR.</i>			
Libby AAF/Sierra Vista	½	ILS 26 200-¾	ILS 26 200-½
<i>Requires installation of MALSR to achieve ½ mile visibility.</i>			
Low Mountain (Closed)	1	None	GPS 30 1180-1½
<i>Controlling obstacle is terrain at 6600' MSL 4,000' NW in missed approach segment. Survey airport to determine compliance with applicable facility design standards.</i>			
Lukachukai	1	None	GPS 12 313-1
<i>Controlling obstacle is powerline at 6483' MSL 1,000' NW. Survey airport to determine compliance with applicable facility design standards.</i>			



**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Marble Canyon	1	None	GPS 3 1517-1½
<i>Controlling obstacle is terrain at 4061' MSL 4,500' NE in missed approach segment. Survey airport to determine compliance with applicable facility design standards.</i>			
Memorial Airfield	1	None	GPS 12 455-1
<i>Controlling obstacle is terrain at 1383' MSL 29,000' NW in final approach segment. Survey airport to determine compliance with applicable facility design standards.</i>			
Mesa-Falcon Field	½	GPS 4R 419-1	GPS 4R 200-½
<i>OCS clear. Requires 180° right turn missed approach procedure to avoid potential penetrations of surface. Procedure dependent on establishment of WAAS by FAA. Airport requires improvements to meet Inner OFZ standards and MALSR installation.</i>			
Nogales International	1	VOR/DME or GPS-B 1268-1½	Same
<i>Proximity of Mexican border precludes final approach segment to R/W 3 within US airspace. GPS 21 yields 1488-1½ due to impact of Patagonia Mountains at 5160' MSL 30,000' NE.</i>			
Page Municipal	½	GPS 15 435-1	GPS 15 200-½
<i>OCS and missed approach segment clear. Final approach overflies Glen Canyon National Recreation Area. Procedure dependent on establishment of WAAS by FAA. Requires land acquisition for MALSR.</i>			
Payson	1	None	GPS 6 383-1
<i>Controlling obstacle is Murphy Point at 5277' MSL 9,000' SW.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Pearce Ferry	1	None	GPS 19 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Phoenix-Deer Valley	½	GPS 7R 562-1	GPS 7R 200-½
<i>OCS and missed approach segment clear. Procedure dependent on establishment of WAAS by FAA. Airport requires improvements to meet Inner OFZ standard and land acquisition to install MALSR.</i>			
Phoenix-Goodyear	½	None	GPS 3 200-½
<i>OCS and missed approach segment clear. Missed approach requires left turn to avoid overflight of residential areas to NE in accordance with noise abatement practices. Procedure dependent on establishment of WAAS by FAA. Requires land acquisition for MALSR.</i>			
Phoenix Sky Harbor International	½	ILS 8R 200-½	Same
<i>Meets target IAP capability.</i>			
Pinal Airpark	1	None	GPS 12 250-1
<i>Final approach and missed approach segments clear. Minimums can be lowered to 250-¾ with installation of SSALS if considered justified; land available.</i>			
Pine Springs	1	None	GPS 5 390-1
<i>Controlling obstacle is terrain at 6955' MSL 500' S. Survey airport to determine compliance with applicable facility design standards.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Pinon	1	None	GPS 1 345-1
<i>Controlling obstacle is terrain at 6380' MSL 13,000' S. Survey airport to determine compliance with applicable facility design standards.</i>			
Pleasant Valley International	1	None	GPS 5 640-1
<i>Requires 5° S offset alignment to avoid impact of Twin Buttes. Controlling obstacle is terrain at 2000' MSL 18,000' SW. Survey airport to determine compliance with applicable design standards.</i>			
Polacca	1	None	GPS 4 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Quartzsite (New)	1	None	GPS 17 250-1
<i>Final approach and missed approach segments clear.</i>			
Rock Point	1	None	GPS 19 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Rocky Ridge	1	None	GPS 21 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			

**Table 5-3**  
**INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Rolle Airfield	1	None	GPS 17 250-1
<i>Final approach segment clear. Missed approach procedure requires 180° left turn to maintain flight within US airspace.</i>			
Ryan Airfield	½	ILS 6R 200-¾	ILS 6R 200-½
<i>Final approach segment clear. Requires land acquisition to install MALSR and achieve ½-mile visibility.</i>			
Safford Regional	1	None	GPS 30 250-1
<i>Final approach and missed approach segments clear.</i>			
San Carlos	1	None	Same
<i>Surrounding terrain in all quadrants precludes practical straight-in, offset or circling IAP capability.</i>			
San Manuel	1	None	GPS 29 305-1
<i>Controlling obstacle is terrain at 3322' MSL 13,000' SE. Survey airport to determine compliance with applicable facility design standards.</i>			
Scottsdale	½	NDB or GPS-B 652-1	GPS 3 200-½
<i>R/W 3 is preferred R/W for noise abatement. Requires increase of TCH to 60' to avoid penetration of OCS W surface by terrain in Phoenix Mountains Preserve at 2429' MSL 31,000' SW. Requires 180° left turn missed approach procedure to avoid high terrain to N and NE. Procedure dependent on establishment of WAAS by FAA. Requires airport improvements to meet applicable primary surface and RSA standards. Requires land acquisition to install MALSR.</i>			

**Table 5-3**  
**INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Sedona	1	NDB or GPS-A 1213-1½	GPS 3 1623-1½
<i>Controlling obstacle is terrain at 6748' MSL 22,000' NE in missed approach segment. Turns in in missed approach encompass similarly high terrain. Airport requires improvements to meet applicable ROFA standard. GPS 3 yields higher minimums than existing NDB or GPS-A approach but provides a straight-in procedure.</i>			
Seligman	1	None	GPS 4 303-1
<i>Requires 7° W offset alignment to avoid high terrain to S. Controlling obstacle is railroad at 5277' MSL 1,000' SW. Airport requires improvements to meet applicable primary surface and ROFA standards.</i>			
Sells	1	None	GPS 4 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Shonto	1	None	GPS 19 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Show Low Municipal	½	NDB or GPS-A 509-1	GPS 24 200-½
<i>OCS and missed approach segment clear. Procedure dependent on establishment of WAAS by FAA. Requires land acquisition to install MALSR.</i>			
Springerville Babbit Field	1	GPS 21 321-1	Same
<i>Meets target IAP capability.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
St. Johns Industrial Airpark	1	VOR/DME or GPS-A 507-1	GPS 14 250-1
<i>Requires 8° N offset alignment to avoid high terrain to NW. Controlling obstacle is terrain at 5800' MSL 6,500' NW. Airport requires improvements to meet applicable standards for primary surface and ROFA.</i>			
Stellar Airpark	1	VOR or GPS-A 465-1	GPS 35 315-1
<i>GPS provides straight-in approach capability. Controlling obstacle is powerline at 1220' MSL 760'S; missed approach segment clear. Final approach overflies Memorial Airpark 17,000' S. Requires 90° right turn missed approach procedure to avoid overflight of Tempe. GPS 17 yields 305-1 with overflights of Tempe 19,000' N and 90° right turn missed approach procedure to avoid overflight of Memorial Airpark to S and Chandler Municipal Airport 32,000' SE. Survey airport to determine compliance with facility design standards.</i>			
Sun Valley	1	None	GPS 36 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Superior Municipal	1	None	Same
<i>Surrounding terrain in all quadrants precludes practical straight-in, offset or circling IAP capability.</i>			
Taylor Municipal	1	None	GPS 3 250-1
<i>Final approach and missed approach segments clear.</i>			

Table 5-3  
**INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Temple Bar	1	None	GPS 18 376-1
<i>Controlling obstacle is terrain at 2490' MSL 27,000' S in missed approach segment. Final approach overflies Lake Mead Recreation Area. Survey airport for compliance with applicable facility design standards.</i>			
Tombstone Municipal	1	None	GPS 6 777-1½
<i>Controlling obstacle is terrain at 5145' MSL 15,500' NE in missed approach segment. Turning missed approach does not reduce minimums.</i>			
Toyey School (Closed)	1	None	GPS 21 250-1
<i>Final approach and missed approach segments clear. Survey airport to determine compliance with applicable facility design standards.</i>			
Tuba City	1	None	GPS 33 447-1
<i>Controlling obstacle is terrain at 4699' MSL 8,000' SE. Survey airport for compliance with applicable facility design standards.</i>			
Tucson International	½	ILS 11L 200-½	Same
<i>Meets target IAP capability.</i>			
Tuweep	1	None	Same
<i>Surrounding terrain in all quadrants precludes practical straight-in, offset or circling IAP capability.</i>			

**Table 5-3  
INITIAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Whiteriver	1	None	GPS 1 1648-1½
<i>Controlling obstacle is Big A Mountain at 6050' MSL 8,000' NE in missed approach segment. Approach overflies City of Whiteriver. Survey airport for compliance with applicable facility design standards.</i>			
Wickenburg Municipal	1	None	GPS 5 894-1¼
<i>Controlling obstacle is Black Mountain at 3108' MSL 14,000' SW.</i>			
Williams Gateway	½	ILS 30C 200-¾	ILS 30R 200-½
<i>CAT I ILS facilities to be relocated to R/W 30R and MALSR to be installed in near future.</i>			
Window Rock	1	RNAV or GPS 2 786-1¼	Same
<i>Best achievable minimums due to surrounding terrain and obstructions.</i>			
Winslow Municipal	1	VOR or GPS 11 423-1	Same
<i>Meets target IAP capability.</i>			
Yuma International	½	ILS 21R 200-½	Same
<i>Meets target IAP capability.</i>			

Note: See Appendix A for acronym definitions.

Sources: 1. Table 5-2.

2. Table 5-1.

3. QED.



To place the initial GPS analysis findings in another perspective, they have been segregated by overall capability into sets as presented in Table 5-4. A total of 11 sets are defined as follows:

Set 1 -- Airports with an existing instrument approach procedure (IAP) that meets the target IAP capability. There are 12 airports in this set.

Set 2 -- Airports with or without an existing IAP that does not meet the target IAP capability. However, there is the potential to establish an IAP capability that will meet the target IAP capability for the airport. These airports also meet the applicable landing surface and facility design standards associated with the potential IAP. There are 16 airports in this set.

Set 3 -- Airports without an existing IAP that does not meet the target IAP capability, but for which there is the potential that an instrument approach can be established. However, the new IAP does not meet the target capability for the airport. These airports meet applicable landing surface and facility design standards. There are 7 airports in this set.

Set 4 -- Airports without an existing IAP and whose geographical setting and surrounding terrain and/or other obstructions are such that an IAP is not viable. There are 5 airports in this set.

Set 5 -- Airports with an existing IAP that does not meet the target IAP capability. However, a new IAP procedure cannot improve upon the existing situation due to surrounding terrain/obstructions that would provide lower approach minimums. There are 2 airports in this set.

Set 6 -- Airports with an existing IAP that does not meet the target IAP capability. However, the establishment of the WAAS by the FAA will enable the airport to have the potential to achieve the target IAP. These airports also meet the applicable landing surface and facility design standards. There are 2 airports in this set.

Set 7 -- Airports with and without an existing IAP that does not meet the target IAP capability. There is the potential to establish an IAP that will meet the target capability. However, the ability of these airports to meet applicable landing surface and facility design standards is not known due to the unavailability of airport layouts and mapping. There are 25 airports in this set.

Set 8 – Airports without an existing IAP, but an IAP can be established. However, the resulting IAP does not meet the target capability. Also, the ability of these airports to meet applicable landing surface and facility design standards is not known due to the unavailability of airport layouts and mapping. There are 3 airports in this set.

Set 9 – Airports with and without an existing IAP, but an IAP can be established. However, the resulting IAP does not meet the target capability and the airports do not meet the applicable landing surface and facility design standards. There are 3 airports in this set.

Set 10 – Airports with and without an existing IAP that does not meet the target IAP capability. An IAP can be established to meet the target, however, these airports do not meet applicable landing surface and facility design standards. There are 10 airports in this set.

Set 11 – Airports with and without an existing IAP that does not meet the target IAP capability. The establishment of WAAS by the FAA will enable these airports to achieve the target IAP capability. However, these airports do not meet the applicable landing surface and facility design standards. There are 11 airports in this set.

These results suggest the following:

1. No improvements in IAP capability are warranted for the 12 airports in Set 1.
2. Certain airports can progress toward establishment of the target IAP capability with a high level of assurance of achieving the intended objective. This would apply to the 16 airports in Set 2.
3. GPS approaches for the 7 airports in Set 3 are also viable candidates even though their IAP capability does not meet the intended target level.
4. The 7 airports in Sets 4 and 5 maintain their existing status as no improvement in their IAP capability can be realized.
5. The 2 airports in Set 6 are viable candidates as soon as the FAA commissions the WAAS for Category I approaches.
6. There are a total of 28 airports in Groups 7 and 8 whose ability to meet standards is not known. Of these airports, 10 do not have a paved runway.

7. The appropriateness of improving the remaining 23 airports accounted in Sets 9, 10 and 11 to comply with the applicable standards consistent with the type of IAP is dependent on two principal factors. These are the cost to achieve standards compliance and the operational benefit afforded by the improved IAP capability. These are reviewed in further detail in the section describing the benefit/cost assessment following Table 5-4.

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Table 5-4  
**INITIAL GPS ANALYSIS GROUPING**

**Set 1 Existing IAP Capability Meets Target IAP Capability (12 airports)**

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Bisbee Dougals International <sup>1</sup> Cochise County Coolidge Municipal <sup>1</sup> Ernest A. Love Field	Estrella Sailport Grand Canyon National Park Phoenix-Sky Harbor Int'l Springerville-Babbit Field	Tucson International Williams Gateway Winslow Municipal Yuma International
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**Set 2 Potential IAP Capability Meets Target IAP And  
Airport Meets Applicable Facility Design Standards (16 airports)**

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Ajo Municipal Avi Suquilla Benson Municipal (New) Colorado City Municipal Cordes Lake (New) Douglas Municipal <sup>1</sup>	Eloy Municipal Globe-San Carlos Regional Grand Canyon West Holbrook Municipal Payson Pinal Airpark <sup>1</sup>	Quartzsite (New) Rolle Airfield Safford Regional Taylor Municipal
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**Set 3 Potential IAP Capability Does Not Meet Target IAP But  
Airport Meets Applicable Facility Design Standards (7 airports)**

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Bagdad Bisbee Municipal Cottonwood Municipal	Glendale Municipal Greenlee County	Tombstone Municipal Wickenburg Municipal
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Table 5-4  
**INITIAL GPS ANALYSIS GROUPING**

**Set 4 Potential IAP Not Capable Due To Obstructions In Airport Setting (5 airports)**

Grand Canyon Bar-Ten Kearny	San Carlos Superior Municipal	Tuweep
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**Set 5 Existing IAP Is Best Achievable But Does Not Meet Target IAP Capability (2 airports)**

Nogales International	Window Rock
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**Set 6 Potential IAP Capability Dependent On Establishment Of WAAS By FAA And  
Airport Meets Applicable Facility Design Standards (2 airports)**

Casa Grande Municipal	Flagstaff-Pulliam
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**Set 7 Potential IAP Capability Meets Target IAP But  
Compliance With Applicable Facility Design Standards Is Not Known (25 airports)**

Ak-Chin Community	Lukachukai	Rocky Ridge	Tuba City
Chinle	Memorial Airfield	San Manuel	
Cliff Dwellers Lodge	Pearce Ferry	Sells	
Flying J Ranch	Pine Springs	Shonto	
Ganado	Pinon	Stellar Airpark	
Grand Canyon Caverns	Pleasant Valley International	Sun Valley	
Greasewood (Closed)	Polacca	Temple Bar	
Hualapai Tribal	Rock Point	Toyey School (Closed)	

Table 5-4

## INITIAL GPS ANALYSIS GROUPING

**Set 8 Potential IAP Capability Does Not Meet Target IAP And  
Compliance With Applicable Facility Design Standards Is Not Known (3 airports)**

Low Mountain (Closed)	Marble Canyon	Whiteriver
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**Set 9 Potential IAP Capability Does Not Meet Target IAP And  
Airport Does Not Meet Applicable Facility Design Standards (2 airports)**

H.A. Clark Memorial	Sedona	
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**Set 10 Potential IAP Capability Meets Target IAP But  
Airport Does Not Meet Applicable Facility Design Standards (10 airports)**

Bowie	Gila Bend Municipal	Seligman
Buckeye Municipal	Kayenta	St. Johns Industrial Airpark
Cochise County	Libby AAF / Sierra Vista	
Duncan-O'Connor Field (Closed)	Ryan Airfield	

**Set 11 Potential IAP Capability Dependent On Establishment Of WAAS By FAA But  
Airport Does Not Meet Applicable Facility Design Standards (11 airports)**

Avra Valley	Laughlin / Bullhead Int'l	Phoenix-Goodyear
Chandler Municipal	Mesa-Falcon Field	Scottsdale
Kingman	Page Municipal	Show Low Municipal
Lake Havasu City Municipal	Phoenix-Deer Valley	

Note: 1. On-airport land available to install SSALS and achieve a ¼-mile reduction in visibility minimum.

## **Benefit / Cost Assessment**

Airports that require improvements to meet landing area and design standards in order to achieve their desired IAP capability should be evaluated with regard with regard to the appropriateness of such investment. An industry-accepted practice employs the use of benefit/cost evaluations to make such assessments. Ratios that are equal to or greater than 1.0 imply that the benefits realized exceed the investment cost. The higher the ratio, the greater the return from the investment. Therefore, benefit/cost assessments were conducted for the 23 airports included in Sets 9, 10 and 11 as identified in the section above.

Each of these 23 airports can achieve their desired or an improved IAP capability but do not meet the applicable landing surface and design standards. The benefit/cost assessment of these airports takes into account the following factors and are described more fully below.

1. The increase in runway end utilization afforded by the potential reduction in approach minimums.
2. The demand for annual instrument approach activity.
3. The operational benefit in dollar terms associated with the potential IAP capability.
4. The cost to achieve standards compliance and install, operate and maintain the appropriate approach lighting system.

Guidelines and data presented in the FAA document, "Establishment and Discontinuance Criteria for Precision Landing System", were used to determine the increased runway utilization due to lowered instrument approach minimums and the operational benefit associated with an instrument approach.

Projections of general aviation aircraft operations (Table 3-6), adjusted to account for itinerant activity based on available individual airport studies, were utilized to derive unconstrained demand forecasts of annual instrument approaches. An instrument approach is an approach made to an airport by an aircraft on an IFR flight plan, when the visibility is less than three statute miles or the ceiling is at or below the minimum initial approach altitude. Studies conducted for the FAA have shown that the counting of instrument approaches is understated, particularly at nontowered airports. Consequently, the methodology utilized in forecasting annual instrument approaches was premised on an unconstrained basis. Unconstrained in the sense that given the potential for an airport to generate a total annual activity level, a certain portion of that activity

represents a demand which could be expected during IFR conditions. This demand level is not constrained by the extent of terminal navigational aids and/or published instrument approaches, but rather is attributable to the type of airport user, trip purpose, type of aircraft and avionics installed.

The methodology utilized in the forecasting process was based on an approach developed for the FAA in the report, "An Improved Forecast Model for Annual Instrument Approaches", prepared by Native American Consultants, Inc. This procedure yields forecasts of annual instrument approaches which take into consideration the propensity to travel in marginal weather and differences in weather characteristics between northern and southern Arizona. The latter addresses a key factor in defining an instrument approach -- that it be conducted in IFR weather conditions. Adjustments to the methodology were applied to reflect an increased propensity to file IFR flight plans through the forecast horizon. These adjustments were based on growth rates anticipated in general aviation instrument operations in the report, "FAA Aviation Forecasts, Fiscal Years 1997- 2008.

The operational benefit for general aviation users of an instrument approach takes into consideration two factors. The first factor is reduced levels of flight disruptions such as delays, diversions and overflights. The second factor is improved safety attributable to the enhanced accuracy of an approach. These operational benefits were estimated by the FAA and adjusted for inflation rates since the initial benefit value determination. The resultant current dollar operational benefit value approximates \$290 per general aviation approach.

The costs to implement a GPS approach are comprised of two factors -- compliance with landing surface and design standards, and installation and operation of an approach lighting system where required. Table 5-5 indicates those airports where such improvements are required to achieve the desired or target IAP capability. Because of the variability in costs to meet applicable landing surface standards (primary surface, runway object free area, runway safety area and obstacle free zone) at each airport, these costs have not been quantified. Nor have costs been established to acquire land for the required installation of an approach lighting system. The SSALS facility requires a land area of 1,600 feet in length and 400 feet in width beginning at the runway threshold. Land area requirements for the MALSR have the same width, however, the length is increased to 2,600 feet. Notwithstanding these limitations, the 20-year cost associated with installing, operating and maintaining a SSALS is \$258,000 in current dollars. The value increases for a MALSR to \$430,000. Whether these approach lighting systems are installed, maintained and operated by federal, state or airport sponsor agencies is moot. The decision to implement the facility needs to weigh benefits and costs.



Alternatively, the operational benefit over a 20-year period in current dollars associated with the potential improved IAP capability has been determined. This value for each airport can be compared to establishment and continuing operations and maintenance costs where applicable, as they may be determined at a later date in airport-specific studies. Benefit/cost ratios can be calculated and those which are equal to or greater than 1.0 imply an economically justified improvement. The higher the value of the resulting benefit/cost ratio, the greater the justification for the improvement. These results are summarized in Table 5-5 and include a Comments section which reflects on the potential ability to achieve a benefit/cost ratio of at least 1.0. Certain values presented in Table 5-5 intuitively suggest a likely determination. These results were then used as input to define the GPS approach recommendation presented in a later section of this report.

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**Table 5-5**  
**BENEFIT / COST ASSESSMENT FOR SELECTED AIRPORTS**

<u>Airport</u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>1</sup></u>	<u>Total 20-Year Operational Benefit (\$) <sup>2</sup></u>	<u>Comments</u>
<b>Set 9</b>			
H.A. Clark Memorial	GPS 18 1300-1½	1,700	Land acquisition costs for ROFA and RSA are likely to exceed \$1,700.
Sedona	GPS 3 1623-1	0	GPS 3 has higher approach minimums than existing NDB or GPS-A. Costs to achieve ROFA standard are likely to exceed operational benefit value.
<b>Set 10</b>			
Bowie	GPS 26 250-1	25,500	Costs to meet primary surface, ROFA and RSA standards are likely to exceed operational benefit value.
Buckeye	GPS 25 250-1	3,630,300	Investment in required improvements to meet ROFA and RSA standards is likely to be economically justified.
Cochise College	GPS 23 250-1	1,693,900	Investment in required improvements to meet ROFA and RSA standards is likely to be economically justified.
Duncan-O'Connor Field (Closed)	GPS 21 533-1	19,500	Costs to meet primary surface, ROFA and RSA standards are likely to exceed operational benefit value.

Table 5-5  
**BENEFIT / COST ASSESSMENT FOR SELECTED AIRPORTS**

<u>Airport</u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>1</sup></u>	<u>Total 20-Year Operational Benefit (\$)<sup>2</sup></u>	<u>Comments</u>
<b>Set 10 (cont.)</b>			
Gila Bend Municipal	GPS 4 302-1	588,400	Investment in required improvements to meet ROFA and RSA standards is likely to be economically justified.
Kayenta	GPS 23 510-1	340,700	Investment in required improvements to meet primary surface, ROFA and RSA standards is likely to be economically justified.
Libby AAF/Sierra Vista	ILS 26 200-½	7,500	Operational benefit does not exceed cost to establish, operate and maintain MALSR.
Ryan Airfield	ILS 6R 200-½	12,600	Operational benefit does not exceed cost to establish, operate and maintain MALSR.
Selignan	GPS 4 303-1	42,200	Costs to meet primary surface and ROFA standards are likely to exceed operational benefit value.
St. Johns Industrial Airpark	GPS 14 250-1	7,700	Costs to meet primary surface and ROFA standards, especially those associated with adjacent Apache Fairgrounds facilities, are likely to exceed operational benefit value.

Table 5-5  
**BENEFIT / COST ASSESSMENT FOR SELECTED AIRPORTS**

<u>Airport</u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>1</sup></u>	<u>Total 20-Year Operational Benefit (\$)<sup>2</sup></u>	<u>Comments</u>
<b>Set 11</b>			
Avra Valley	GPS 12 200-½	908,900	Investment to acquire land and install, operate and maintain MALSR is economically justified.
Chandler Municipal	GPS 4R 200-½	413,300	Costs to acquire land and install, operate and maintain MALSR may be economically justified. Operational benefit of an approach with 250-¾ minimums based on SSALS is \$297,300, a value which may also be economically justified.
Kingman	GPS 21 200-½	156,700	Excluding costs to meet primary surface standard, costs to install, operate and maintain MALSR are not likely to be economically justified. Operational benefit of an approach with 250-¾ minimums based on SSALS is \$96,700 and also not likely to be economically justified.
Lake Havasu City Municipal	GPS 32 200-½	1,184,200	Costs to meet primary surface standard and acquire land to install, operate and maintain MALSR are likely not to be economically justified.
Laughlin / Bullhead International	GPS 34 314-½	16,846,900	Costs to meet Inner OFZ and TERPS 332 standards and acquire land to install, operate and install, operate and maintain MALSR are likely to be economically justified.

Table 5-5  
**BENEFIT / COST ASSESSMENT FOR SELECTED AIRPORTS**

<u>Airport</u>	<u>Initial Potential IAP (Type, HAA/HAT-VIS)<sup>1</sup></u>	<u>Total 20-Year Operational Benefit (\$) <sup>2</sup></u>	<u>Comments</u>
<b>Set 11 (cont.)</b>			
Mesa-Falcon Field	GPS 4R 200-½	408,400	Costs to meet Inner OFZ standard and install, operate and maintain MALSR may be economically justified. GPS 4R with SSALS yields minimums of 250-¾ and operational benefit value of \$281,800 may also be economically justified.
Page Municipal	GPS 15 200-½	179,400	Costs to acquire land and install, operate and maintain MALSR are not economically justified. GPS 15 with SSALS yields 250-¾ and an operational benefit value of \$127,100 and is also not economically justified.
Phoenix-Deer Valley	GPS 7R 200-½	908,100	Investment to install, operate and maintain MALSR is economically justified.
Phoenix-Goodyear	GPS 3 200-½	9,575,500	Investment to acquire land and install, operate and maintain MALSR is economically justified.
Scottsdale	GPS 3 200-½	1,580,800	Costs to meet primary surface and ROFA standards and acquire land to install, operate and maintain MALSR may be economically justified.
Show Low Municipal	GPS 12 200-½	57,700	Costs to acquire land and install, operate and maintain MALSR are not economically justified. GPS 24 with SSALS yields 250-¾ and an operational benefit value of \$44,500 and is also not economically justified.

See Appendix A for acronym definitions.  
Sources: 1. Table 5-3. 2. QED.

## Airport System Services

The development of a plan for GPS approaches should also reflect airport system objectives. These may affect a final determination of required individual airport approach capabilities and do not include reliance on airports in bordering states. The primary system objective related to the determination of airports with ½-mile visibility approach capability. It was considered desirable for each system airport to be within a 100-n.m. range of such airports. This provides a viable alternate airport for filing IFR flight plans or for other in-flight needs.

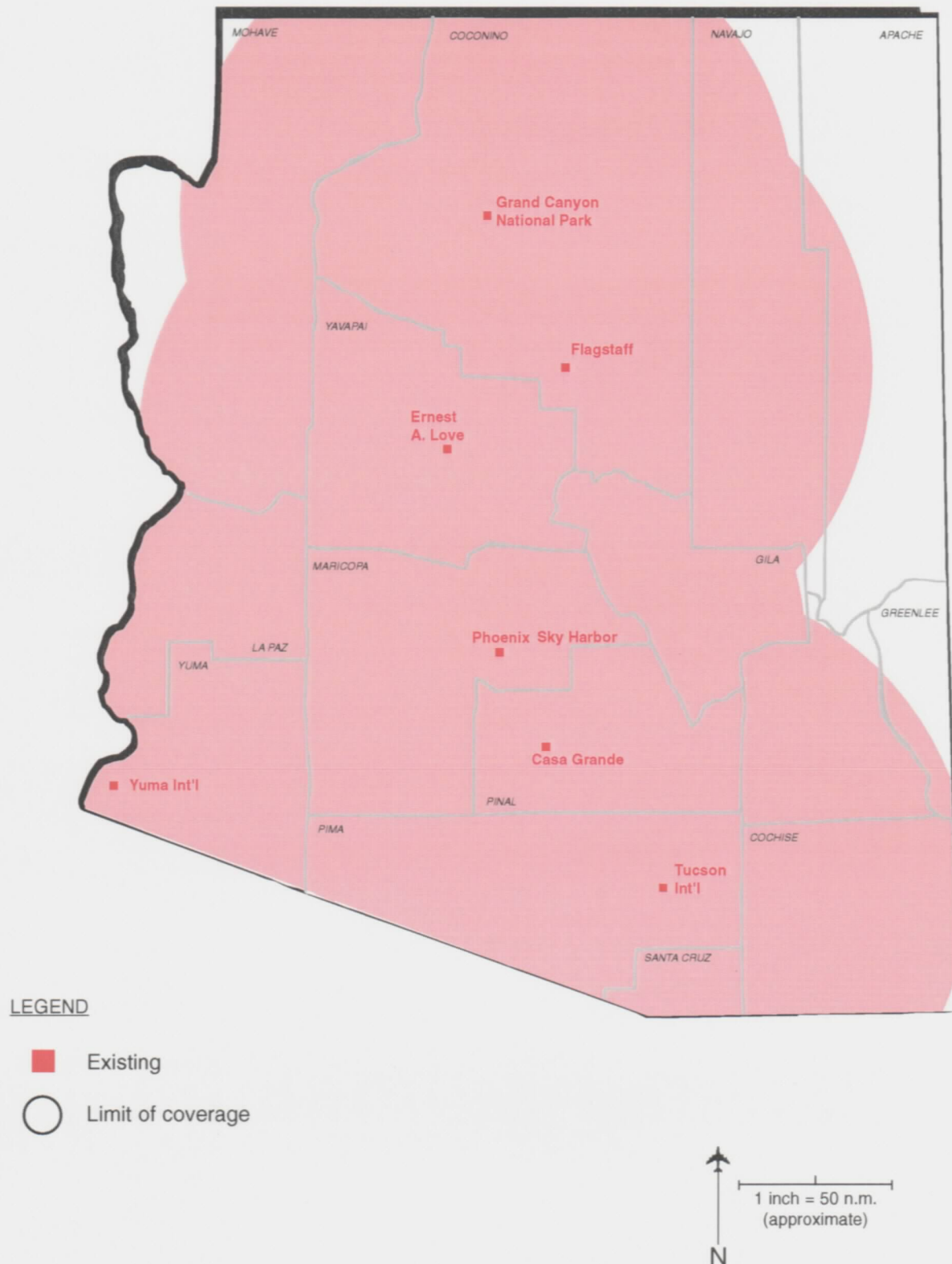
Figure 5-1 illustrates the area coverage afforded by the existing system of airports with visibility approach minimums of ½-mile. Most of Arizona is provided with the desired coverage with some gaps and several areas of overlap. At a minimum, the ability to provide ½-mile visibility minimums at the following airports could provide the coverage required to meet this system service objective:

1. Lake Havasu City and either Laughlin/Bullhead or Kingman for areas in northwest Arizona.
2. Page, Show Low and Libby AAF/Sierra Vista for areas along the eastern boundary of Arizona.

The initial potential IAP evaluation summarized in Table 5-2 indicates that each of the above airports can achieve the target ½-mile visibility minimum. However, each will require some improvements to meet applicable landing surface and design standards, and all but Libby AAF/Sierra Vista are dependent on the establishment of WAAS by the FAA. The applicable costs to achieve this IAP capability may or may not be economically justified.

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Figure 5-1  
**EXISTING SYSTEM AREA COVERAGE**  
*(1/2-MILE VISIBILITY MINIMUM)*



## GPS Approach Recommendations

The final recommendations for the most appropriate GPS approach for each system airport are presented in Table 5-6. These recommendations take into account the following factors:

1. Ability to achieve the target IAP capability from the application of TERPS guidelines and criteria.
2. Operational benefit values versus costs to meet applicable standards and install, operate and maintain an approach lighting system.
3. Airport system objectives with regard to area coverage.
4. Lack of airport mapping information.

Notwithstanding the landing surface and facility design standards defined by the FAA, it was assumed for the purposes of this study that airports intended to be provided with an instrument approach also be served with an all-weather landing surface. Therefore, if an unpaved runway is not programmed for such improvement, pursuit of an IAP is not recommended. Conversely, if an IAP is necessary, then the runway should be paved.

The initial potential IAP analysis (Table 5-3 and Table 5-4 Sets 1 and 2) identified four airports which meet applicable standards to achieve lower than the target visibility. These airports (Bisbee Douglas International, Coolidge Municipal, Douglas Municipal and Pinal Airpark) also have the land resources available to install an SSALS to achieve the lower ( $\frac{3}{4}$ -mile) visibility minimum. Therefore, the benefit/cost of installing, operating and maintaining the SSALS was evaluated. However, in each case, these airports have insufficient activity levels during the course of the next 20 years to economically justify the installation, operation and maintenance of the SSALS. Consequently, these airports are not recommended for such improvements.

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Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Ajo Municipal	1	None	GPS 30 402-1
	<i>No comments.</i>		
Ak-Chin Community	1	None	GPS 17 250-1
	<i>Procedure subject to standards compliance survey. Associated improvement costs should not exceed \$17,200 to be economically justified.</i>		
Avi Suquilla	1	VOR/DME or GPS-A 1271-1½	GPS 1 271-1
	<i>No comments.</i>		
Avra Valley	½	None	GPS 12 200-½
	<i>Procedure dependent on establishment of WAAS by FAA. Acquire land and install MALSR.</i>		
Bagdad	1	None	GPS 5 1057-1½
	<i>No comments.</i>		
Benson Municipal (New)	1	None	GPS 28 250-1
	<i>Airport to be designed to meet all applicable standards.</i>		
Bisbee Douglas International	1	VOR/DME or GPS 17 317-1	Same
	<i>Operational benefit value of GPS 17 with SSALS yielding 317-¾ is \$900. SSALS is not economically justified.</i>		

Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Bisbee Municipal	1	None	GPS-A 1120-1½
<i>No comments.</i>			
Bowie	1	None	Same
<i>Initial potential IAP is not economically justified.</i>			
Buckeye Municipal	1	None	GPS 25 250-1
<i>Improve airport to meet applicable ROFA and RSA standards.</i>			
Casa Grande Municipal	½	ILS/DME 5 285-½	GPS 5 200-½
<i>Procedure dependent on establishment of WAAS by FAA.</i>			
Chandler Municipal	½	VOR or GPS 4L 446-1	GPS 4R 200-½
<i>Procedure economically justified if total costs to acquire land and install, operate and maintain MALSR do not exceed \$413,300. Procedure dependent on establishment of WAAS by FAA. Consider establishing GPS 4R yielding 250-¾ if costs to acquire land and install SSALS do not exceed \$297,300. Otherwise, opt for GPS 4R yielding 250-1.</i>			
Chinle	1	None	GPS 17 365-1
<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$585,200 to be economically justified.</i>			
Cliff Dwellers Lodge	1	None	GPS 22 663-1
<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$14,100 to be economically justified.</i>			

Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Cochise College	1	None	GPS 23 250-1
<i>Improve airport to meet applicable ROFA and RSA standards.</i>			
Cochise County	1	GPS 21 354-1	Same
<i>No comments.</i>			
Colorado City Municipal	1	NDB-A 829-1½	GPS 29 489-1
<i>No comments.</i>			
Coolidge Municipal	1	GPS 23 486-1	Same
<i>Operational benefit value of GPS 23 with SSALS yielding 486-3/4 is \$3,200. SSALS is not economically justified.</i>			
Cordes Lake (New)	1	None	GPS 19 745-1
<i>Airport to be designed to meet all applicable standards.</i>			
Cottonwood Municipal	1	None	GPS 32 1310-1½
<i>No comments.</i>			
Douglas Municipal	1	None	GPS 21 427-1
<i>Operational benefit of GPS 21 with SSALS yielding 427-3/4 is \$202,300. SSALS is not economically justified.</i>			
Duncan-O'Connor Field (Closed)	1	None	Same
<i>Initial potential IAP is not economically justified.</i>			

**Table 5-6  
FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Eloy Municipal	1	None	GPS 20 250-1
	<i>No comments.</i>		
Ernest A. Love Field	½	ILS/DME 21L 200-½	Same
	<i>No comments.</i>		
Estrella Sailport	N/A	None	Same
	<i>No comments.</i>		
Flagstaff-Pulliam	½	ILS/DME 21 250-½	GPS 21 200-½
	<i>Procedure dependent on establishment of WAAS by FAA.</i>		
Flying J Ranch	1	None	GPS 19 550-1
	<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$4,600 to be economically justified.</i>		
Ganado	1	None	GPS 18 398-1
	<i>Procedure dependent on providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$7,700 to be economically justified.</i>		
Gila Bend Municipal	1	None	GPS 4 302-1
	<i>Procedure economically justified if costs to provide ROFA and RSA do not exceed \$588,400.</i>		
Glendale Municipal	½	None	GPS 1 250-¾
	<i>Operational benefit of GPS 19 with SSALS yielding 250-¾ is \$5,782,500. SSALS is economically justified.</i>		

**Table 5-6**  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Globe-San Carlos	1	None	GPS 27 565-1
	<i>No comments.</i>		
Grand Canyon Bar-Ten	1	None	Same
	<i>No comments.</i>		
Grand Canyon Caverns	1	None	GPS 23 394-1
	<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$18,900 to be economically justified.</i>		
Grand Canyon National Park	½	ILS/DME 3 200-½	Same
	<i>No comments.</i>		
Grand Canyon West	1	None	GPS 35 305-1
	<i>No comments.</i>		
Greasewood (Closed)	1	None	GPS 4 300-1
	<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$9,500 to be economically justified.</i>		
Greenlee County	1	None	GPS 7 949-1¼
	<i>No comments.</i>		
H.A. Clark Memorial Field	1	None	Same
	<i>Initial potential IAP is not economically justified.</i>		

Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Holbrook Municipal	1	None	GPS 21 323-1
	<i>No comments.</i>		
Hualapai Tribal	1	None	GPS 7 483-1
	<i>Procedure subject to standards compliance survey. Associated improvement costs should not exceed \$17,500 to be economically justified.</i>		
Kayenta	1	None	GPS 23 510-1
	<i>Procedure economically justified if total costs to improve ROFA and RSA do not exceed \$340,700.</i>		
Kearny	1	None	Same
	<i>No comments.</i>		
Kingman	½	VOR/DME or GPS 21 359-1	Same
	<i>Target ½ mile visibility minimum is not economically justified. Area coverage to meet system objective is better served by Laughlin/Bullhead International.</i>		
Lake Havasu City Municipal	½	VOR/DME or GPS-A 939-1¼	GPS 32 200-½
	<i>Improve airport to meet applicable primary surface standard and acquire land to install MALSR. Procedure dependent on establishment of WAAS by FAA.</i>		
Laughlin / Bullhead International	½	GPS 34 1208-1½	GPS 34 314-½
	<i>Improve airport to meet applicable standards for Inner OFZ and TERPS 332, and acquire land and install MALSR. Procedure dependent on establishment of WAAS by FAA.</i>		

**Table 5-6**  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Libby AAF / Sierra Vista	½	ILS 26 200-¾	ILS 26 200-½
<i>Installation of MALSR to achieve ½-mile visibility is not economically justified. However, it is warranted to meet system area coverage in eastern Cochise and southern Greenlee counties.</i>			
Low Mountain (Closed)	1	None	GPS 30 1180-1½
<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$2,900 to be economically justified.</i>			
Lukachukai	1	None	GPS 12 313-1
<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$10,900 to be economically justified.</i>			
Marble Canyon	1	None	GPS 3 1517-1½
<i>Procedure subject to standards compliance survey. Associated improvement costs should not exceed \$6,900 to be economically justified.</i>			
Memorial Airfield	1	None	GPS 12 455-1
<i>Procedure subject to standards compliance survey. Associated improvement costs should not exceed \$605,600 to be economically justified.</i>			
Mesa-Falcon Field	½	GPS 4R 419-1	GPS 4R 200-½
<i>Procedure economically justified if total cost to meet standards for Inner OFZ and installation, operation and maintenance of MALSR do not exceed \$408,400. Procedure dependent on establishment of WAAS by FAA.</i>			

Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Nogales International	1	VOR/DME or GPS-B 1268-1½	Same
	<i>No comments.</i>		
Page Municipal	½	GPS 15 435-1	GPS 15 200-½
	<i>Initial potential IAP is not economically justified. However, it is warranted to meet system area coverage in northern Navajo and Apache counties.</i>		
Payson	1	None	GPS 6 383-1
	<i>No comments.</i>		
Pearce Ferry	1	None	GPS 19 250-1
	<i>Procedure subject to providing an all-weather runway surface and standards compliance survey. Associated improvement costs should not exceed \$16,600 to be economically justified.</i>		
Phoenix-Deer Valley	½	GPS 7R 562-1	GPS 7R 200-½
	<i>Improve airport to meet applicable standards for Inner OFZ and acquire land to install MALSR. Procedure dependent on establishment of WAAS by FAA.</i>		
Phoenix-Goodyear	½	None	GPS 3 200-½
	<i>Improve airport to acquire land and install MALSR. Procedure dependent on establishment of WAAS by FAA.</i>		
Phoenix Sky Harbor International	½	ILS 8R 200-½	Same
	<i>No comments.</i>		



Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Pinal Airpark	1	None	GPS 12 250-1 <i>Operational benefit value of GPS 12 with SSALS yielding 250-¼ is \$4,900. SSALS is not economically justified.</i>
Pine Springs	1	None	GPS 5 390-1 <i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$6,300 to be economically justified.</i>
Pinon	1	None	GPS 1 345-1 <i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$19,500 to be economically justified.</i>
Pleasant Valley International	1	None	GPS 5 640-1 <i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$4,000 to be economically justified.</i>
Polacca	1	None	GPS 4 250-1 <i>Procedure subject to standards compliance survey. Associated improvement costs should not exceed \$20,400 to be economically justified.</i>
Quartzsite (New)	1	None	GPS 17 250-1 <i>Airport to be designed to meet all applicable standards.</i>

Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Rock Point	1	None	GPS 19 250-1
<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$33,000 to be economically justified.</i>			
Rocky Ridge	1	None	GPS 21 250-1
<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$20,400 to be economically justified.</i>			
Rolle Airfield	1	None	GPS 17 250-1
<i>No comments.</i>			
Ryan Airfield	½	ILS 6R 200-¾	Same
<i>No comments.</i>			
Safford Regional	1	None	GPS 30 250-1
<i>No comments.</i>			
San Carlos	1	None	Same
<i>No comments.</i>			
San Manuel	1	None	GPS 29 305-1
<i>Procedure subject to standards compliance survey. Associated improvement costs should not exceed \$50,500 to be economically justified.</i>			

Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Scottsdale	½	NDB or GPS-A 652-1	GPS 3 200-½
<i>Procedure is economically justified if total cost to meet standards for primary surface and RSA, and to acquire land to install, operate and maintain MALSR do not exceed \$1,580,800. Procedure dependent on establishment of WAAS by FAA.</i>			
Sedona	1	NDB or GPS-A 1213-1½	Same
<i>No comments.</i>			
Seligman	1	None	Same
<i>No comments.</i>			
Sells	1	None	GPS 4 250-1
<i>Procedure subject to compliance standards survey. Associated improvement costs should not exceed \$7,200 to be economically justified.</i>			
Shonto	1	None	GPS 19 250-1
<i>Procedure subject to providing an all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$20,400 to be economically justified.</i>			
Show Low Municipal	½	NDB or GPS-A 509-1	GPS 24 200-½
<i>Land acquisition and installation of MALSR to achieve 200-½ is not economically justified. However, it is warranted to meet system area coverage in northern Greenlee and southern Apache counties. Procedure dependent on establishment of WAAS by FAA.</i>			

Table 5-6  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Springerville Babbit Field	1	GPS 21 321-1	Same
	<i>No comments.</i>		
St. Johns Industrial Airpark	1	VOR/DME or GPS-A 507-1	Same
	<i>No comments.</i>		
Stellar Airpark	1	VOR or GPS-A 465-1	GPS 35 250-1
	<i>Procedure subject to compliance standards survey. Associated improvement costs should not exceed \$6,600 to be economically justified.</i>		
Sun Valley	1	None	GPS 36 250-1
	<i>Procedure subject to compliance standards survey. Associated improvement costs should not exceed \$20,400 to be economically justified.</i>		
Superior Municipal	1	None	Same
	<i>No comments.</i>		
Taylor Municipal	1	None	GPS 3 250-1
	<i>No comments.</i>		
Temple Bar	1	None	GPS 18 376-1
	<i>Procedure subject to compliance standards survey. Associated improvement costs should not exceed \$325,200 to be economically justified.</i>		

**Table 5-6**  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Tombstone Municipal	1	None	GPS 6 777-1¼
	<i>No comments.</i>		
Toyel School (Closed)	1	None	GPS 21 250-1
	<i>Procedure subject to compliance standards survey. Associated improvement costs should not exceed \$600 to be economically justified.</i>		
Tuba City	1	None	GPS 33 447-1
	<i>Procedure subject to compliance standards survey. Associated improvement costs should not exceed \$585,500 to be economically justified.</i>		
Tucson International	½	ILS 11L 200-½	Same
	<i>No comments.</i>		
Tuweep	1	None	Same
	<i>No comments.</i>		
Whiteriver	1	None	GPS 1 1648-1½
	<i>Procedure subject to providing and all-weather runway surface and a standards compliance survey. Associated improvement costs should not exceed \$1,100 to be economically justified.</i>		
Wickenburg Municipal	1	None	GPS 5 894-1¼
	<i>No comments.</i>		

**Table 5-6**  
**FINAL GPS ANALYSIS**

<u>Airport</u>	<u>Target Visibility (sm)<sup>1</sup></u>	<u>Present Best IAP (Type, HAA/HAT-VIS)<sup>2</sup></u>	<u>Recommended IAP (Type, HAA/HAT-VIS)<sup>3</sup></u>
Williams Gateway	½ <i>No comments.</i>	ILS 30C 200-¾	ILS 30R 200-½
Window Rock	1 <i>No comments.</i>	RNAV or GPS 2 786-1¼	Same
Winslow Municipal	1 <i>No comments.</i>	VOR or GPS 11 423-1	Same
Yuma International	½ <i>No comments.</i>	ILS 21R 200-½	Same

Note: See Appendix A for acronym definitions.

Sources: 1. Table 5-2.

2. Table 5-1.

3. QED.

Table 5-7 provides a convenient summary of the approach capability by type and situation. Airports are grouped by those with and without an existing IAP capability and then by a mix of nine potential outcomes. Some noteworthy outputs of this classification process are:

#### Airports Without An Existing IAP

Group 1 -- A total of 25 airports are expected to have a GPS approach capability which meets the desired level and can be economically justified, that is, have benefit/cost ratios equal to or greater than 1.0.

Group 2 -- There are 29 airports which have the potential to achieve a GPS approach provided the costs to improve the airport to applicable standards is at least equal to the anticipated 20-year stream of operational benefits.

Group 3 -- Site conditions at 5 airports preclude the introduction of a GPS approach.

Group 4 -- There are 5 airports which have activity levels that do not economically justify a GPS approach. One of these airports is limited by function (sailplanes) to VFR-only status.

#### Airports With An Existing IAP

Group 5 -- There are 11 airports that can realize an improved IAP capability and which are justified either economically (8) or for area coverage system objectives (3). Of these, 7 airports are dependent on the establishment of WAAS by the FAA.

Group 6 -- A total of 10 airports meet their desired or target IAP capability.

Group 7 -- There are 4 airports that can be improved to meet their target IAP capabilities provided the costs do not exceed the 20-year stream of operational benefits. Three of these airports are dependent on the establishment of WAAS by the FAA.

Group 8 -- There are 3 airports that have the best achievable minimums and cannot meet the desired or target IAP capability.

Group 9 -- There are 3 airports that have activity levels insufficient to economically justify an improvement to their IAP capability.

Table 5-7  
**FINAL GPS ANALYSIS GROUPING**

**Group 1   Airports Without An Existing IAP And An IAP Is Justified (25 airports)**

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Ajo Municipal	Douglas Municipal <sup>2</sup>	Pinal Airpark
Avra Valley <sup>1</sup>	Eloy Municipal	Quartzite (New)
Bagdad	Glendale Municipal	Rolle Airfield
Benson Municipal (New)	Globe-San Carlos Regional	Safford Regional
Bisbee Municipal	Grand Canyon West	Taylor Municipal
Buckeye Municipal	Greenlee County	Tombstone Municipal
Cochise College	Holbrook Municipal	Wickenburg Municipal
Cordes Lake (New)	Payson	
Cottonwood Municipal	Phoenix-Goodyear <sup>1</sup>	

**Group 2   Airports Without An Existing IAP And AIP May be Justified Subject To Cost Limitations (29 airports)**

---

Ak-Chin Community	Low Mountain (Closed)	Rocky Ridge
Chinle	Lukachukai	San Manuel
Cliff Dwellers Lodge	Marble Canyon	Sells
Flying J Ranch	Memorial Airfield	Shonto
Ganado	Pearce Ferry	Sun Valley
Gila Bend Municipal	Pine Springs	Tempe Bar
Grand Canyon Caverns	Pinon	Toyey School (Closed)
Greasewood (Closed)	Pleasant Valley International	Tuba City
Hualapai Tribal	Polacca	Whiteriver
Kayenta	Rock Point	



Table 5-7  
**FINAL GPS ANALYSIS GROUPING**

**Group 3   Airports Without An Existing IAP And None Is Viable (5 airports)**

Grand Canyon Bar-Ten  
Kearny

San Carlos  
Superior Municipal

Tuweep

**Group 4   Airports Without An Existing IAP And An IAP Is Not Justified (5 airports)**

Bowie  
Duncan-O'Connor Field (Closed)

Estrella Sailport<sup>3</sup>  
H.A. Clark Memorial

Seligman

**Group 5   Airports With An Existing IAP That Can Be Improved and Is Justified (11 airports)**

Avi Suquilla  
Casa Grande Municipal<sup>1</sup>  
Colorado City Municipal  
Flagstaff-Pulliam<sup>1</sup>

Lake Havasu City Municipal<sup>1</sup>  
Laughlin / Bullhead Int'l<sup>1</sup>  
Libby / Sierra Vista<sup>4</sup>  
Page<sup>1,4</sup>

Phoenix-Deer Valley<sup>1</sup>  
Show Low Municipal<sup>1,4</sup>  
Williams Gateway

**Group 6   Airports With An Existing IAP That Meet Target IAP Capability (10 airports)**

Bisbee Douglas International<sup>2</sup>  
Cochise County  
Collidge Municipal<sup>2</sup>  
Ernest A. Love Field

Grand Canyon National Park  
Phoenix Sky Harbor Int'l  
Springerville-Babbit Field  
Tucson International

Winslow Municipal  
Yuma International

Table 5-7  
**FINAL GPS ANALYSIS GROUPING**

**Group 7    Airports With An Existing IAP That Can Be Improved Subject To Cost Limitations (4 airports)**

Chandler Municipal <sup>1</sup>	Scottsdale <sup>1</sup>
Mesa-Falcon Field <sup>1</sup>	Stellar Airpark

**Group 8    Airports With An Existing IAP But Cannot Meet The Target IAP Capability (3 airports)**

Nogales International	Sedona	Window Rock
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**Group 9    Airports With An Existing IAP Whose Improvement Cannot Be Justified (3 airports)**

Kingman	Ryan Airfield	St. Johns Industrial Airpark
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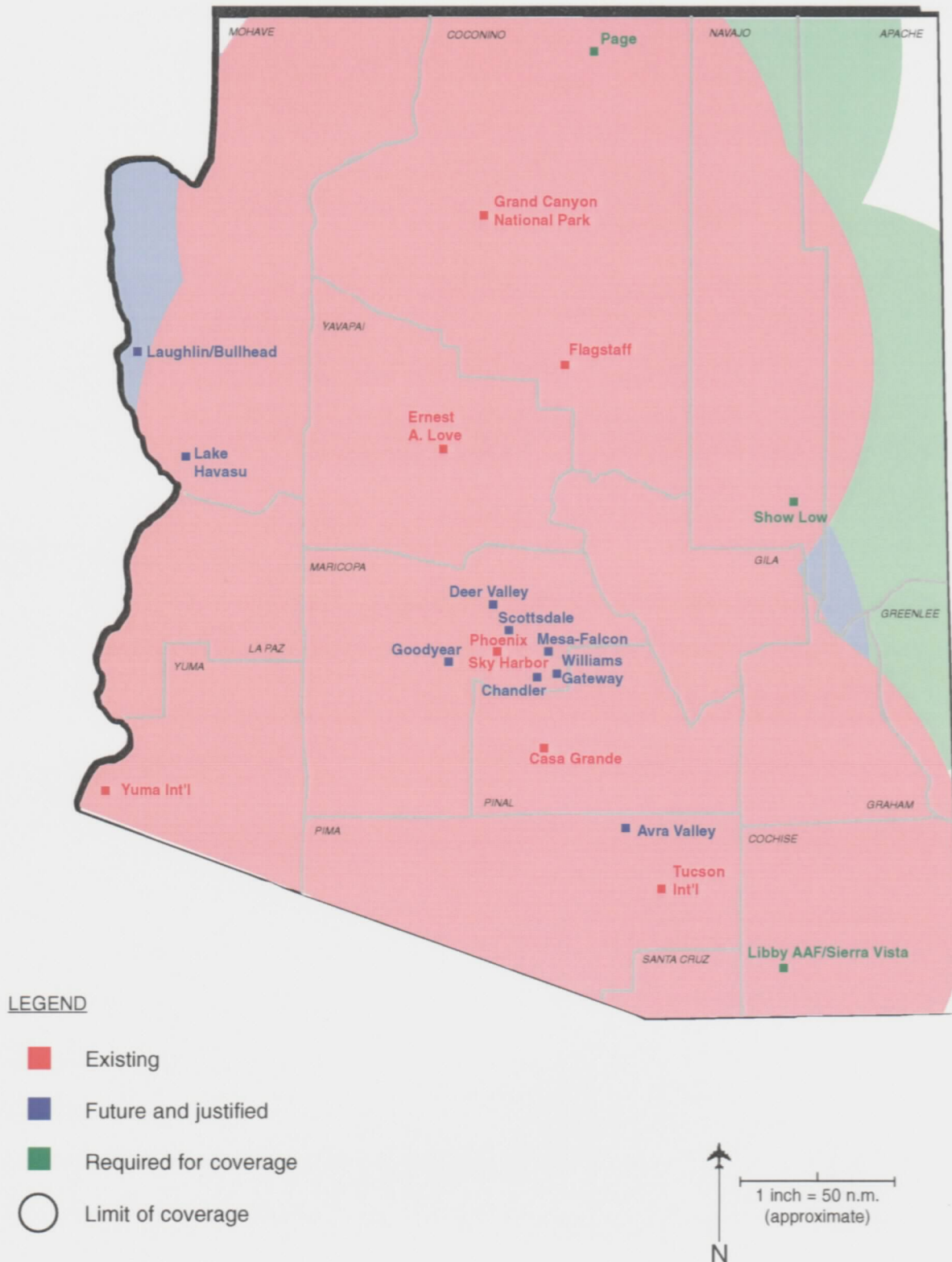
- Notes: 1. Dependent on WAAS.  
 2. SSALS not economically justified to achieve ½-mile visibility minimum.  
 3. VFR-only airport.  
 4. IAP not economically justified but warranted for area coverage system objective.

Source: Table 5-6.

Figure 5-2 illustrates the contribution afforded by Libby AAF/Sierra Vista, Page Municipal and Show Low Municipal airports to achieve the ½-mile/100n.m. system service objective. Additionally, airports located in adjacent states also contribute to meeting this system objective. These include those airports serving Las Vegas, Nevada; Durango, Colorado; and Cedar City, Utah. Further, in the event of emergencies, military bases with aviation missions are available to serve civilian aircraft.

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Figure 5-2  
**FINAL SYSTEM AREA COVERAGE**  
*(1/2-MILE VISIBILITY MINIMUM)*



## **Differential GPS**

Chapter 4 provided an assessment of existing and future technologies for navigation. One concept, the pre-LAAS or differential GPS, is available for implementation as SCAT-I systems. A benefit of this technology is that the differential GPS signal may serve all runway ends at airports within a 20-mile to 30-mile range of its transmission.

This capability is presently being considered at the Phoenix Sky Harbor International Airport. When implemented, it could serve as a means of providing appropriately designed airports in the Phoenix Valley region with a Category I RNP capability prior to the establishment of WAAS by the FAA. This capability would apply to the Chandler Municipal, Glendale Municipal, Mesa-Falcon, Phoenix-Deer Valley, Phoenix-Goodyear and Scottsdale airports. These airports should invest in the necessary improvements to meet the landing surface and runway design standards applicable to their target approach capability as presented in previous sections of this chapter.

Although individual airports have received SCAT-I installations, the Phoenix proposal would represent the industry's first test of differential GPS to serve more than one runway end as well as other airports. Because of the need for Category I RNP capability in the currently high air traffic activity Valley region, this proposal should be given careful consideration by potential public and private parties.

The cost to establish a SCAT-I system is approximately \$500,000 including an allowance of \$100,000 for installation. These costs are based on an operating requirement of 3 ground stations (receivers) and 1 transmitter. In addition, there is the requirement to acquire and install a MALSR which represents an additional \$250,000 investment. Operating costs for the SCAT-I system are minimal – power and emergency back-up systems. The MALSR will require an annual operating and maintenance budget of about \$9,000.

## **Instrument Approach Training**

The availability of more GPS approaches at Arizona system airports also provides an operational benefit to instrument approach flight training activities. Flight training in areas of northeastern Arizona will be a prime beneficiary inasmuch as there is a current lack of airports which can support such activity in this geographic area. This deficiency has created the need to fly relatively long distances to conduct instrument approach training flights. Additionally, new GPS approaches at more airports serves to redistribute the demand for such training activity at the relatively more busy airports in the system.